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A Buried Peat Bed in Dodge Township, Union County, Iowa

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A BURIED PEAT BED IN DODGE TOWNSHIP, UNION COUNTY, IOWA.

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Union county already occupies a notable place in the annals of the Pleistocene geology of our State. Near the towns of Thayer and Afton Junction are exposed the gravel beds which first furnished the basis for the separation of the drift of the pre-Kansan age from that of the Kansan, and for the establishment of the Aftonian interglacial interval. The name of this latter age of American geology was taken from the town of Afton which is located not far from the above mentioned gravel exposures, in Union county.

Near the southeast corner of Dodge township a small, drift bordered stream crosses sections 35 and 36, and renders tribute to the Grand river a short distance east of the border of the township. About the middle of section 36 the waters of this stream have cut into the bank which borders it on the south and exposed the following succession of beds:

		FEET
4.	Fine-grained, pebbleless soil, dark gray in color at the surface, changing to yellow in the deeper portions.....	2
3.	Yellow colored drift bearing numerous pebbles and small bowlders, maximum thickness.	21
2.	Bed made up of alternating layers of brown colored vegetable matter and fine-grained, light gray sand. Greatest exposed thickness.....	6½
1.	Blue colored bowlder clay containing numerous pebbles and small bowlders of granite, greenstones, quartz and quartzite	10

It will be seen from the above section that the exposure reveals two beds of drift which are separated from each other by an accumulation of vegetable material. Since this particular area is embraced within the region whose superficial till is of Kansan age, the age of the lower or older drift, number 1 of the section, can be safely referred to that of the pre-Kansan.

The materials of this bed are dark blue in color with the exception of a zone about three feet in depth in the upper part. The superficial portion of this zone is iron-stained and is deep brown in color to a depth of two to four inches. Below this brown horizon the color changes to a light gray and this, in turn, passes with a gradual transition into the blue colored drift below. The constituents of this drift are calcareous to the very top of the bed. The clay shows nothing of the jointed structure that is a common feature of the beds of Kansan till. It contains numerous pebbles and small bowlders few of which exceed twelve inches in diameter.

The second member of the section consists of narrow layers of quite pure peaty material intercalated between layers of sand. At the very base of this bed, and immediately overlying the iron-stained horizon of number 1, there is a layer of clean, fine-grained, light colored sand about four inches in thickness. This bed of sand is succeeded by a layer of brown vegetable matter, three to four inches in depth, which in places is crowded with branches and splinters and fragments of wood. With these coarser wood-fragments are mingled masses of more or less comminuted and disintegrated remains of vegetable matter.

The entire thickness of the second member, above this basal layer of organic material, is made up of layers of fine-grained, light colored sand, which vary in thickness from two to four inches, alternating with brown colored layers of vegetable debris about equal in thickness with those of the sand. These layers of organic matter contain a surprisingly small admixture of sedimentary impurities. They are so compact that they stand out in conspicuous

PLATE X.

Peat bed of Aftonian age. The vegetable layer exposed has a maximum thickness of 6½ feet.

relief on the face of the bluff where exposed to the influences of weathering. See plate X.

Among the plants whose remains were found in these upper vegetable layers there occur the stems and leaves and rhizoids of species of mosses which Prof. J. M. Holzinger has identified with *Hypnum* (*Camptothecium*) *nitens* (Schreb.) Schimp, and *Hypnum* (*Harpidium,*) *fluitans* Linn. Both of the above mosses are aquatic species. The former lives at present only in peat bogs and prairie swamps of more northern lands. The latter has a wider distribution. It inhabits ponds and marshes in both northern and temperate latitudes. With these mosses were also found the rootstock of a small species of fern, blades of some strap-shaped, grass-like leaves, and a fragment of a leaf resembling that of a species of populus. Numerous leaves and twigs of some cone bearing trees also occur. The leaves on these branchlets are sessile. They are jointed to short sterigmata or pedestals, and are arranged along the twig in a manner similar to those of species of Picea or Spruce. Disconnected limbs and wing-covers of beetles are occasionally encountered.

The layers of organic matter are thicker near to, and above, the middle of the member. Many of the sand layers show very thin, brown laminæ of peaty substance which indicate that even the deposition of the sand material took place very slowly.

This peat bearing member is exposed in the face of a bluff for a distance of about one hundred feet. Near the west end of the exposure a small ravine has been cut back into the hill for a distance of half a dozen rods. The vegetable horizon appears in the bank on either side of this ravine, and it is overlain with a thickness of more than twenty feet of yellow colored till.

Number 3 of the section represents a bed of Kansan drift whose lime constituent is leached from its superficial portion, and whose iron content is oxidized to a greater or less degree throughout its entire depth. There is nothing peculiar in the color or in the contents of this till as here exposed.

Number 4 is a soil mantle of fine-grained material that has been developed upon the surface of the Kansan drift during the long interval that has elapsed since the disappearance of the Kansan glacier. This pebbleless soil band and the underlying bed of Kansan drift are so familiar to all of you that they require no special discussion. Iowa geologists have encountered the drift of pre-Kansan age at various points in the State and are well acquainted with its characteristics. It is to the time of accumulation, the composition, and the manner of deposit of the materials which compose the second member, the bed of organic matter, to which I would request your consideration.

It is evident that we have here to do with an accumulation that has slowly taken place in the basin of a lake or pond. The large amount of moss in many of the vegetable layers of the member testifies to the slow rate of growth of the deposit, and to the long time during which the basin was in process of filling.

The oxidized, iron-stained band which occurs in the superficial portion of the lower drift, and which forms the floor of the basin, would indicate that the surface of the pre-Kansan drift had been exposed to the atmosphere for a long period previous to its existence as a lake bed. Also, the presence of numerous branches and fragments of wood in the lowermost layer of organic matter would be strong evidence that the deposit did not begin to accumulate immediately after the withdrawal of the pre-Kansan ice sheet. If this basin was one of the numerous depressions that were left over the surface when the pre-Kansan ice melted, the first vegetation to become established in this pool would have been species of algae, aquatic mosses, and other lowly types of water-loving plants. Not until hundreds of years after the withdrawal of the ice sheet would the drift surface become clothed with forests. Not until long centuries had elapsed after the disappearance of the glacier would there be developed conditions which would result in the accumulation of such a layer of wood fragments on the floor of a newly formed lake or pond.

The facts disclosed in this exposure seem to indicate a succession of events somewhat as follows: There is first recorded an invasion of the region by the pre-Kansan ice sheet and the deposit of the bed of bowlder clay which constitutes the first member of the section. This drift buried the preglacial forests and concealed all traces of pre-Pleistocene life. Upon the withdrawal of the ice sheet the surface of this area was subjected to the agencies of leaching and oxidation as land surfaces are today. During this time there was developed the brown colored zone in the superficial portion of this bed of drift.

After a long period, and possibly well towards the middle of the Aftonian age, some cause or causes resulted in the formation of a shallow basin over a portion of the area which formerly existed as a land surface. This new basin may have resulted from a land slip or cut off, or it may have been formed by a beaver dam or by the closing of the outlet of a stream which drained this particular region. In this forest-encircled depression waters collected. Small streams began at once to carry into it fine detritus.

In this pool water-loving mosses became established, and semi-aquatic vegetation flourished along its borders. Twigs and small branchlets that were broken from the trees during violent wind-storms came to rest in the water, and contributed their substance to the filling of the basin. During a long series of dry seasons a layer of almost pure vegetable matter would accumulate over the bottom of the bog. During a succession of seasons of greater rainfall a bed of sandy sediments would be spread over the floor. In some of these layers of sand there are thin, brown colored laminae so numerous that, in places, as many as twenty-five can be counted in the thickness of one inch. Each of these laminae probably represents the carbonaceous substance of a single season's growth of vegetation during the periods when the deposition of mechanical sediments predominated over the accumulation of vegetable matter on the floor of the marsh.

After the long continuance of such conditions as these, the pond became filled with detritus, the water was banished from the basin, and during the later portion of the Aftonian age this area was again a land surface. When the Kansan glacier moved down from the northward it carried an immense load of debris. These materials buried deeply the old Aftonian surface concealing alike forests and peat bog, the stream channels and the bordering hills. Since that time a soil mantle has been developed upon the Kansan surface, and the streams of the region have carved deeply the soft materials of the once level drift plain. In some places, as at the point above described, the cutting has been so deep as to expose deposits in which are recorded the vicissitudes of earlier geological ages.

The most of you will remember the pre-Kansan peat bed that was exposed at Oelwein, and described for the Academy a few years ago by Professor Macbride.* From the vegetable material that came from that deposit Professor Holzinger and Dr. G. N. Best have found the following species of mosses:† *Hypnum* (*Harpidium*) *fluitans* Linn., *Hypnum* (*Harpidium*) *revolvens* Swartz, and *Hypnum* (*Calliergon*) *richardsoni* Lesq. and James. Fragments of the first named species are much more plentiful in the Oelwein deposit than those of all other species combined, while in the material from Union county the remains of that species are comparatively rare. Concerning the present habitat of the two latter species Lesquereux and James state, in their mosses of North America, that *Hypnum revolvens* occurs in deep swamps from northern Ohio to Alaska, and *Hypnum richardsoni* is reported only from British America and the coast of Greenland.

The peat deposit at Oelwein is of corresponding age with that in Union county. Like that of the latter, also, its accumulation occupied a long period of time. The plant remains which occur in that northern bed bear testimony to the same facts as those in the exposure in the more southern portion of the State. It seems fair to assume

* Iowa Academy of Sciences, Vol. IV, p. 63 et seq.
† The Bryologist, November, 1903.

that the species of plants whose remains occur in these widely separated deposits afford some definite and trustworthy information regarding the climatic conditions that prevailed during the Aftonian interval.

Buried forests beds and fragments of the wood of trees which now flourish in more northern latitudes have been found at various points in Iowa. Where these trunks and wood fragments occur on the surface of a soil horizon they may represent only such trees as were growing at the close of an interglacial interval, and were overwhelmed by the oncoming of the ice. These forests may be such as were developed near the close of the interval in response to a climate that was cooled by the proximity of the slowly advancing glacier.

If the bed of vegetable material in Union county, and that at Oelwein, represent a long continued accumulation which took place neither at the very beginning nor at the very close of the Aftonian age, the species of plants whose remains are found in these deposits would testify to the general character of the Aftonian climate, unmodified by cooling winds that blew either from advancing or retreating ice masses.

The scarcity in these deposits, of fragments of our deciduous forest trees, and the presence, in abundance, of leaves and twigs and pieces of wood of cone bearing trees, such as live at present in higher latitudes, is significant. The absence in these beds of the aquatic moss species that predominate today in the lakes and pools of Iowa, and the occurrence there of species of mosses which now flourish further northward, furnish strong evidence that during the Aftonian age the climate of our state was favorable for the growth of a more boreal vegetation than at present.

The conclusion seems warranted that many of the plants which are found in the present flora of our state had no place here during that earliest interglacial interval, and that, at our latitude, the climate never became so mild and genial throughout this period as that which the region enjoys during the present age.